Amrita School of Computing
Amrita Vishwa Vidyapeetham, Chennai

Department of Computer Science and Engineering (AIE)

Advancing Real-Time Accident Detection Mechanism with IoU-Driven AI Models and Intelligent Emergency Response System

Project Phase 2
Review – 2
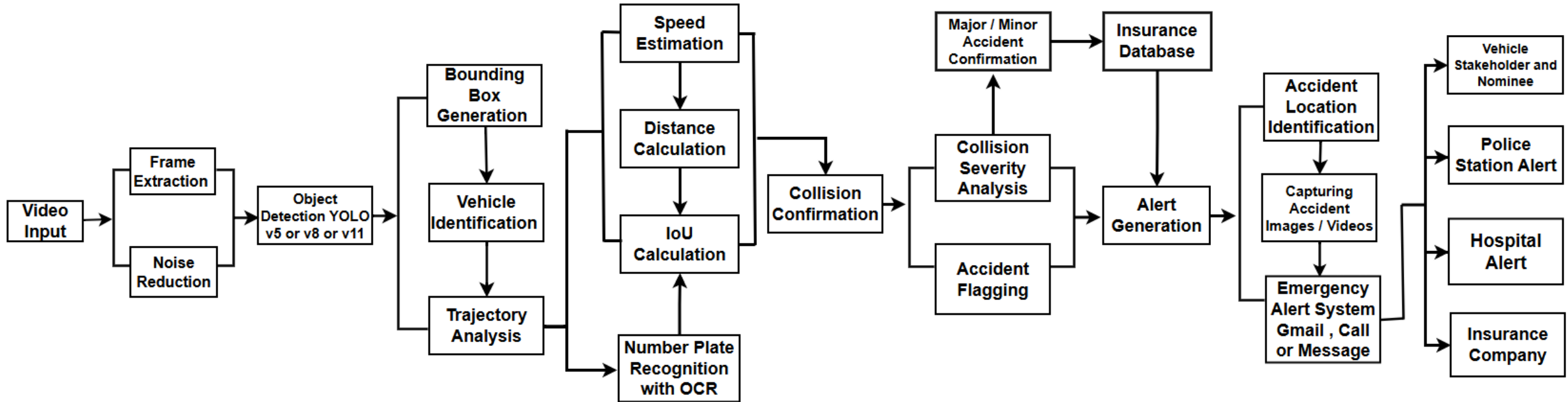Team – A8
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Data Flow Diagram

Requirements

Functional Requirements:

- Detect accidents in real-time using YOLOv11.
- Send alerts to emergency contacts and services.
- Auto-initiate insurance claims and damage estimation.
- Recognize vehicles via number plate detection.
- Notify nominees and enable organ/blood donation processes.

Non-Functional Requirements:

- Real-time alerts with low latency (<2 seconds).
- High accuracy (IoU >85%) and system reliability (24/7).
- Scalable for multiple accident scenarios.
- Secure data handling and user-friendly interface.

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Proposed Methodology

Dataset: Pre-Trained on COCO (Common Objects in Context) and Accident Dataset.

**Preprocessing:** Image resizing and label formatting for YOLOv5 and YOLOv8 models.

Focus: Including traffic-related objects like vehicles, pedestrians, and bicycles. Models: YOLOv5 (speed), YOLOv8 (accuracy), and YOLOv11 (advanced precision and real-time efficiency).
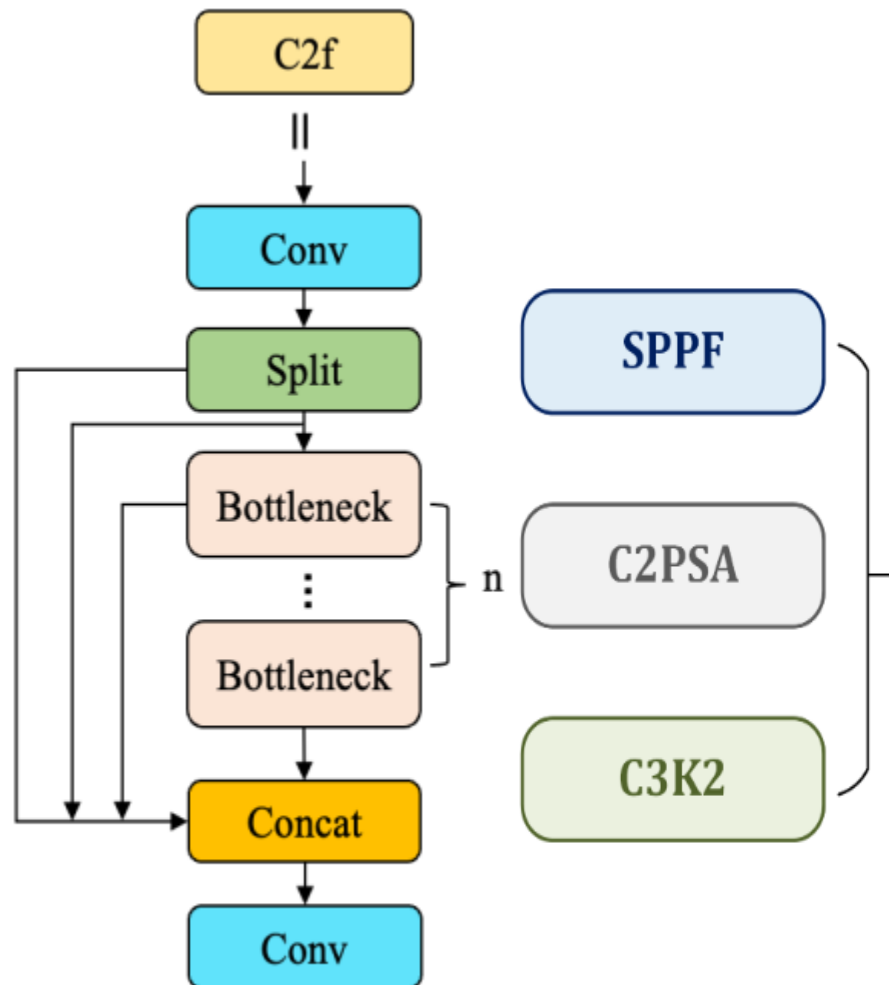
Training Process:

- Dataset split into training and validation sets.
- Pre-trained weights used for transfer learning.
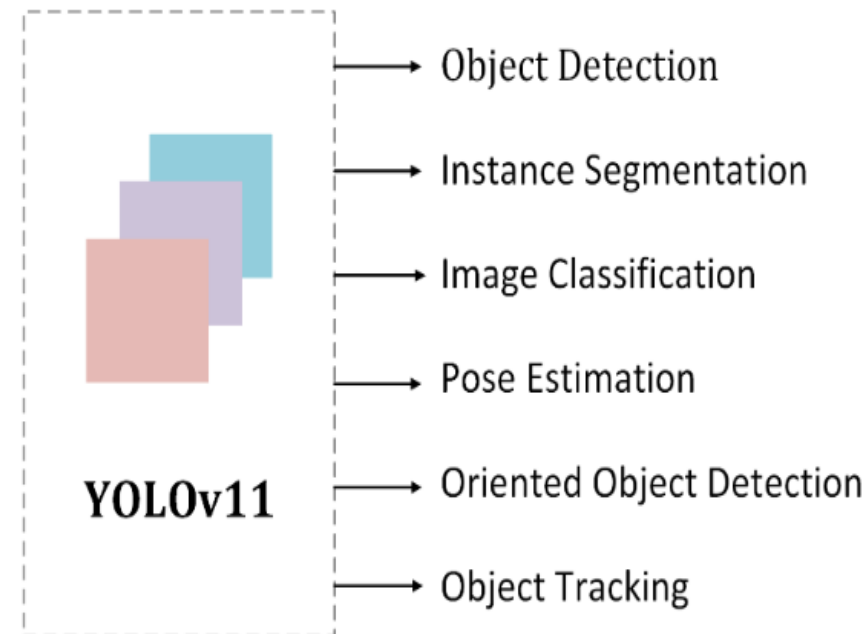- Validation ensures model robustness.
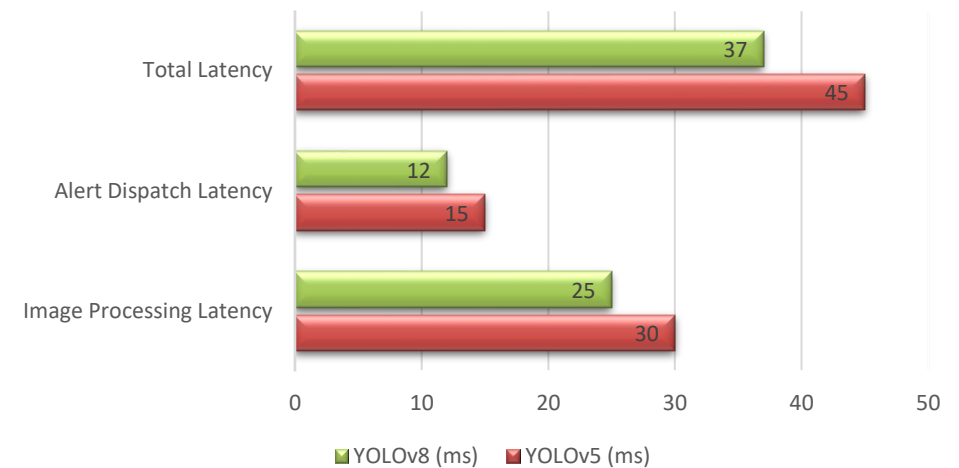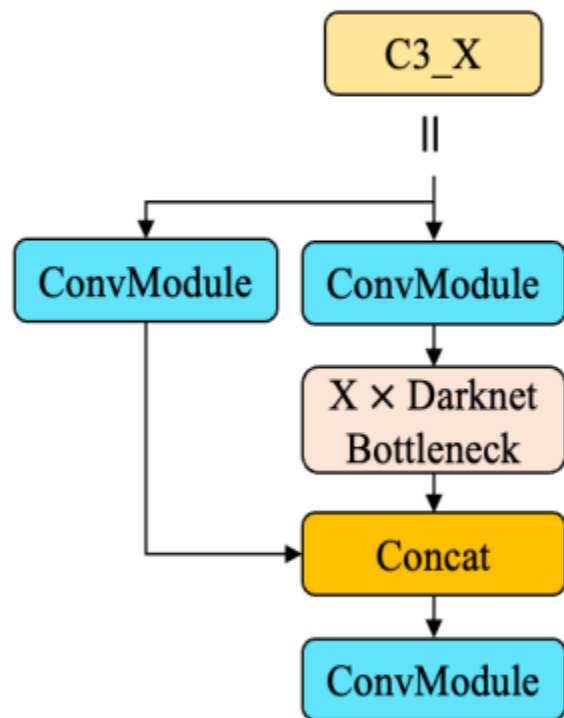
YOLOv5

YOLOv8
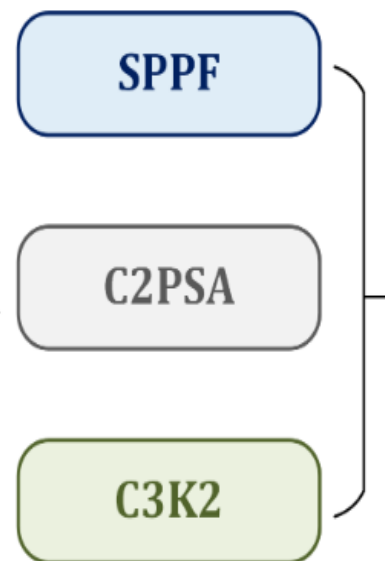
YOLO Models Architectures

Accident Detection Mechanism

1. Video frame capture via OpenCV.

2. **Object detection:** Bounding boxes and classifications.

3. **Collision detection:** Intersection over Union (IoU) metric.

4. **Number Plate Identification:** Number plate identified using OCR recognition.

5. **Alert generation:** Nearest emergency services and insurance policy holders notified using Overpass API and Haversine formula .

Accident Detection Mechanism

Insurance Automation:

- Automate damage assessment using AI models.

- Generate and process insurance claims automatically.

- Send alerts to policyholders and their nominees.

- Prioritize organ and blood donation requests based on the severity of injuries, especially for cases of brain death or severe blood loss.

New Findings

New Findings:

- Advanced accident detection with YOLOv11 ensuring high precision and real-time alerts.

- Integration of automated insurance claims and damage estimation using number plate recognition.

- Life-saving features: Organ donation and blood donation alerts in critical cases.

Importance to Society/Technology:

- Reduces emergency response time, saving lives in critical scenarios.

- Enhances road safety through efficient accident reporting and data-driven insights.

- Automates insurance processes, reducing delays and improving user experience.

New Findings

Stakeholders:

- Emergency responders (ambulance, police, hospitals).

- Insurance companies and policyholders.

- Vehicle owners, government agencies, and NGOs (blood/organ banks).

Applications:

- Real-time accident monitoring and alerting systems.

- Smart cities and intelligent traffic management.

- Insurance automation and fraud detection.

- Public health initiatives (organ and blood donation coordination).

Detailed Accident Report

Accident Detection System - Critical Report

1 message

<pranavreddy772003@gmail.com>   Sun, 8 Dec 2024 at 23:48
To: 772003pranav@gmail.com

Accident Detection System - Detailed Report
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Incident Details:

Date and Time: 2024-12-08 23:48:08
Location: Latitude 19.07, Longitude 72.877

Collision Metrics:

Total Collision Count: 42
Maximum Detected Speed: 608.30 px/s

Weather Conditions:

Description: smoke
Temperature: 25.0°C

Vehicle Events:

Detected Events: Heavy acceleration, Overspeeding, Hard braking

Nearest Emergency Services:

Police Station: Nehru Nagar Kurla E Police Chowky
Police Station Distance: 0.6832456726261971 km
Hospital: arpan nursing home
Hospital Distance: 0.1356844468604801 km

Severity Assessment:

HIGH SEVERITY: Immediate emergency response required

Emergency Response Recommendation:

Immediate medical and law enforcement assistance is strongly recommended.
Please verify the exact location and proceed with caution.

Note: This is an automated system-generated report. Always confirm details with on-site assessment.

Justifications of Findings

❑ Accident Detection: YOLOv11 ensures higher IoU and real-time precision, outperforming earlier models.

❑ Insurance Automation: Automates claims and damage estimation, reducing manual errors and delays.

❑ Life-Saving Alerts: Integrates blood/organ donation systems, addressing critical medical emergencies efficiently.

Outcomes of the Project

❑ Reduced emergency response times by up to 40%.Simplified insurance claim processes for quicker resolutions.

❑ Increased organ and blood availability for patients in critical need.

❑ Improved road safety through accurate, real-time monitoring.

Thank You